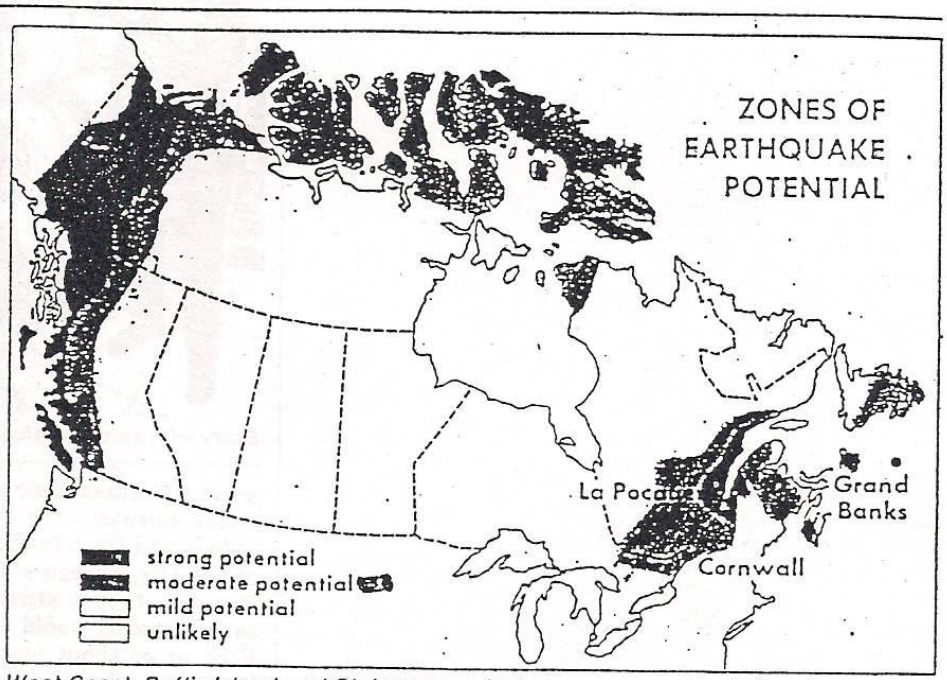
Predicting the Eastern Canadian quake

By Terence Dickinson

Few of the several thousand people living within several hundred kilometres of the St. Lawrence River realize that theirs is among the more earthquake-prone regions of North America. Yet only two years ago, people in the town of La Pocatière suddenly heard their windows and dishes rattling. "All at once our furnace started running and the telephone rang," recalls resident Claude LeBlond, who had a job monitoring government seismic records and immediately suspected the reason. But his family and neighbors were startled to learn that what had shattered the calm of a late-summer afternoon was a Richter magnitude-5 quake.

For those residents who generally associate earthquakes with the notoriously tremor-prone West Coast, the findings of a Pennsylvania State University professor have come as an even greater surprise. After sifting through records of this and other earth tremors in the region, Professor Benjamin Howell revealed recently there's a 40-per-cent chance of a major jolt in the St. Lawrence Valley within the next 10 years. His computer projections, based on past trends, indicate that Eastern Canada is jostled by a magnitude-7 tremor every 60 years on average. The intensity of such a quake would not only knock people off their feet but cause heavy property damage. In the unnerving example of Cornwall, Ont., which was hit by a milder 5.9 tremor in 1944, damage amounted to $2 million, and plaster and facade masonry crashed to the ground. Canadian seismologists, who record about 300 shocks in Canada every year, agree that, along with Baffin Island, Eastern Canada is one of the two most potentially dangerous quake zones east of the Rockies. But because of the difficulty of predicting such earthquakes, Howell emphasizes that he is only identifying "*potential* earthquake hazards" for the region: "We don't know enough about their causes to predict their occurrences."

Aftermath of the 5.9 Cornwall tremor



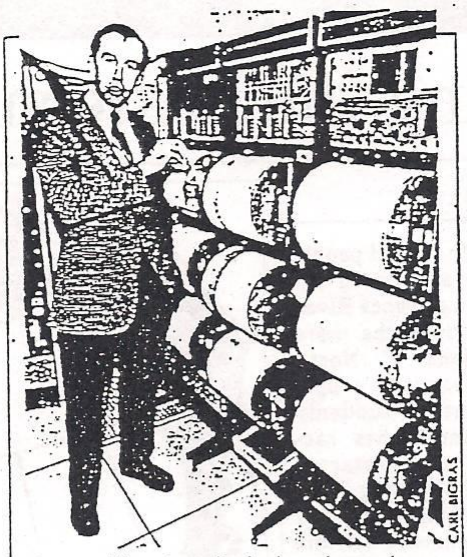
West Coast, Baffin Island and St. Lawrence Valley—severe potential quake zones

Earthquake prediction, always a difficult business, is particularly complicated in the St. Lawrence Valley, where quakes are not triggered by the usual causes. Geophysicists blame most quakes on continental drift or plate tectonics. The crust of the earth consists of about a dozen continent-sized rafts of rock which float on the surface of the hot underlying mantle—disturbance zones lie where these plates grind together or overlap. Yet according to Queen's University geologist Edward Farrar, in Kingston, Ont., the main problem in the St. Lawrence stems from fractures along ancient fault lines in the plate itself, causing slippage. "But," admits Farrar, "the exact location of the faults remains uncertain."

To make matters even more difficult, many shocks in Eastern Canada go unnoticed due to the rarity of actual ground fissures. Furthermore, western quakes, more easily detectable by their upheaval of earth, may cause more limited economic damage than the resounding seismic waves in the centre of a plate. In the St. Lawrence Valley, "the quakes appear to occur totally at random, and the amount of real estate involved is immense," according to Michael Berry, director of the division of seismology and geothermal studies of Energy, Mines and Resources' earth physics branch in Ottawa. Even though on the periphery of the "hottest" area (see map), Quebec City risks being shaken by a magnitude-7 earthquake.

Although Berry concurs with Howell's statistical analysis of the area, he will project only that a major quake is "overdue" in the St. Lawrence Valley. For six years, Berry's team of seismologists has staked out the valley with an array of seismometers and tiltmeters in search of tremor indications. But even with consistent monitoring, Berry admits the team didn't notice anything different before or after the 1979 La Pocatière quake—which struck right in the vicinity of their equipment.

The plethora of new methods for investigating tremor-prone regions has done little to sharpen man's predictive ability for quakes. Seismologists can boast laser devices that measure ground warping to within a millimetre over a distance of five kilometres, huge mobile vibrators and precisely controlled explosions to generate pressure waves for detecting stressed rock, and tiltmeters capable of sensing ground uplifts of a few centimetres. Nevertheless, few ex-



Berry with seismological equipment

perts will stake their reputations on a quake forecast—the Brian Brady episode is still fresh in their minds. Brady, of the U.S. Bureau of Mines, predicted last year that a series of increasingly severe quakes would occur near Lima, Peru, on or about June 28, Aug. 10 and Sept. 16. To Brady's chagrin, the quakes failed to appear.

Ironically, unconventional ancient methods of prediction may outstrip science's best offerings. The Chinese, who spend far more than any country on earthquake research and who lost three-quarters of a million people in a 1976 quake, still successfully employ primitive techniques to pinpoint tremors. Before a devastating 1975 quake in the Liaoning province of Manchuria, for example, snakes were seen freezing in the winter air and roosters crowed all night. Sensitivity to these signs allowed a million Chinese to be removed from the area safely. Events in Italy's Friuli region prior to a 1976 quake forced Western scientists to take such notions seriously. Dogs howled, cats ran into the street and penned cows tried to break free. Biochemist Helmut Tributsch of the Fritz Haber Institute in Berlin has suggested that before a major quake hits, the earth releases ions into the atmosphere, possibly irritating the delicate sensory mechanisms of many animals. Animals might also detect the very low frequency rumbles (inaudible to humans) that precede earthquakes.

Whether or not Canadian predictions become more accurate, the question paramount to residents is personal safety. So far, the only reported Canadian earthquake deaths occurred in a 1929 quake on the Grand Banks that created a tidal wave and killed 27 people. "A person is at greater risk," says Farrar, "of being hit by lightning in Eastern Canada during his lifetime than being killed by the effects of an earthquake."